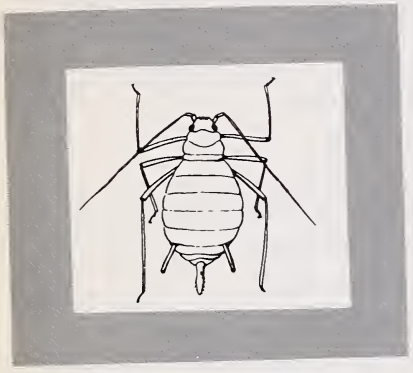
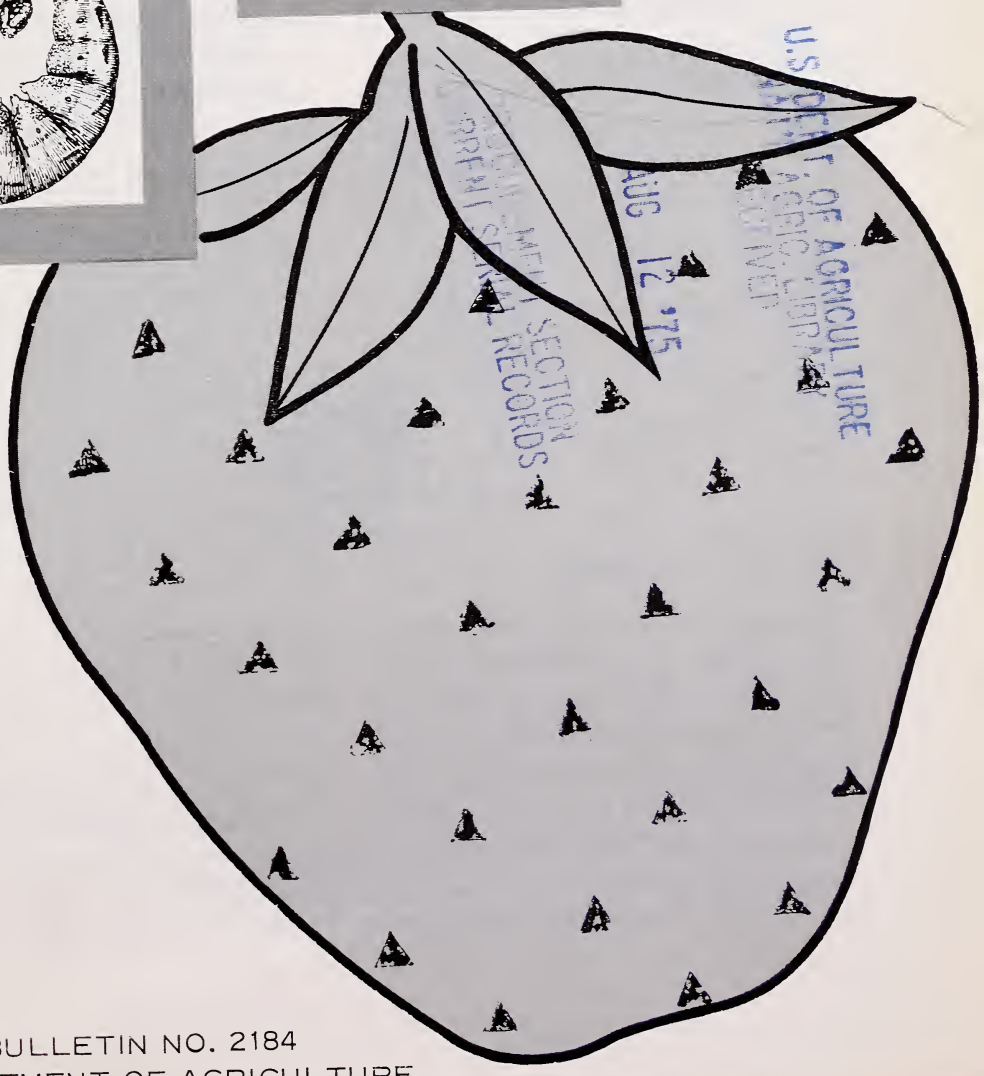
STRAWBERRY INSECTS

. . . HOW TO CONTROL THEM





FARMERS BULLETIN NO. 2184
U.S. DEPARTMENT OF AGRICULTURE

CONTENTS

Washington, D.C.

Revised March 1972
Slightly revised March 1975

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402 - Price 40 cents
Stock Number 001–000–03402–2
Catalog No. A 1.9:2184/7

STRAWBERRY INSECTS: ... How to control them

This bulletin is addressed to the commercial strawberry grower, but the home gardener may also find it useful. The home gardener may use carbaryl, chlordane, diazinon, dicofol, endosulfan, ethylene dibromide, malathion, methoxychlor, tetradifon, and toxaphene to control the insects described in this bulletin provided he carefully follows the directions and precautions on the labels. Carbophenothion, demeton, methyl bromide, mevinphos, and parathion are not recommended for use by the home gardener.

When applying dust with power equipment, drive slowly. Air velocity at the nozzles should be high enough to force dust to all parts of the foliage, but not high enough to blow it from the leaves. If the wind is a problem, you may be able to reduce the drift of dust by attaching a lightweight canvas drag behind the duster.

Many species of insects and related pests attack strawberries, causing heavy losses to growers. Most of these pests injure plants by feeding on roots, stems, leaves, flower buds, or flowers. Some ruin or contaminate the fruit.

Certain insects cause severe damage before their presence is known. One is the cyclamen mite, which is so small it cannot be seen by the naked eye. Others are the root weevil larvae, which feed underground, and aphids, which may spread virus diseases without causing noticeable feeding injury.

Control of insects is essential to high yields of good-quality berries.

INSECTICIDES

Insecticides to control strawberry pests should be applied with ground equipment. Dusts or sprays are equally effective.

Dusts

Ready-to-use dusts are available from insecticide dealers.

Apply an even, light coating of dust; apply 15 to 30 pounds to each acre, using maximum amount when plants are largest.

Sprays

Spray materials are sold as emulsifiable concentrates or as wettable powders; they must be diluted with water. When purchasing, read the container labels to be certain the materials are suitable for use on plants.

Either emulsifiable concentrates or wettable powders may be applied with a high-gallonage sprayer at a rate of

100 gallons or more per acre. If you use a low-gallonage sprayer (10 to 25 gallons per acre), use only an emulsifiable concentrate; a wettable powder may clog the nozzles of the sprayer.

Mixing sprays.—If you use an emulsifiable concentrate, first measure out the amount required for the acreage your spray tank will cover with one filling. Add an equal quantity of water, and mix thoroughly to make a stable emulsion. Add this emulsion to the necessary quantity of water to make a full tank of total spray and stir or agitate. In application, see that each acre receives the amount of active ingredient indicated in the accompanying table.

If you use a wettable powder, add a small quantity of water to it and stir vigorously to make a smooth paste or slurry; add this mixture to the required quantity of water. While applying the spray, agitate it continuously to prevent the powder from settling to the bottom of the tank.

The following table shows the maximum amount of active ingredient of each insecticide to apply to each acre if applied to the foliage. Smaller quantities may be adequate when plants are small.

Insecticides and dosages to apply to foliage for control of strawberry insects

Insecticide [1]	Formulation [2]	Pounds of active ingredient per acre
Carbaryl	WP	2
Carbophenothion	EC or WP	½
Chlordane	D or EC	1
Demeton	EC	⅜
Diazinon	D or EC	1
Endosulfan	D, EC, or WP	1
Dicofol	D, EC, or WP	¾
Malathion	D, EC, or WP	2
Methoxychlor	EC or WP	1¾
Mevinphos	D or EC	1
Parathion	D, EC, or WP	½
Tetradifon	EC or WP	1
Toxaphene	D or EC	3

[1] Refer to discussions of specific insects in the text before selecting insecticide.

[2] D = dust; EC = emulsifiable concentrate; WP = wettable powder.

Controlling Root Damage

To destroy insects that live in the soil and damage roots of plants, such as strawberry root weevils or wireworms, apply an emulsifiable concentrate, wettable powder, or granules to the soil surface before planting; thoroughly work the insecticide into the soil. Refer to discussion of specific insects in this publication to find dosages and directions.

OTHER CONTROL MEASURES

Follow these practices to reduce losses caused by strawberry insects:

- Plant only virus-free and aphid-free stock. Virus diseases are spread by aphids and they weaken plants and reduce yield. Many virus-free varieties are now available from nurseries throughout the country.
- Isolate new fields as far as possible from existing strawberry plantings.
- Use a crop rotation in which strawberries are planted to follow a different, clean-cultivated crop grown the year before. Strawberries should not follow corn, weeds, or grass; they should not be planted on land that has grown strawberries during the previous 3 years.
- If young plants are not free from aphids or other insects, immerse them

in hot water or fumigate them with methyl bromide before planting (see page 4).

- Plant in fertile, well-drained soil; use a fertilizer recommended by your county agricultural agent.
- Keep down weeds and grasses. Clean culture is an important measure because many insects feed and breed on weeds, and prefer grassy fields.
- Plow under old strawberry fields immediately after the last harvest season.

INSECTS AND RELATED PESTS

Aphids

Leaf Aphids

DN–550

Description and habits.—Several species. Soft-bodied insects; adults less than 1/16 inch long. Wingless form is pale green or yellowish; winged form is light green and has black markings. Usually occurs on new shoots and buds in crown of plant; when numerous, they move to undersides of leaves. These insects are sluggish, and generally remain motionless while plants are being examined. Several generations occur in a season. Most numerous in spring and fall; almost disappear in hot, dry summer.

Damage.—In some localities, these aphids become numerous enough to injure plants by sucking out the juices. Their chief damage is the spreading of virus diseases, such as yellows. Virus diseases are spread mostly by winged aphids, during early spring and fall.

Distribution.—One or more species throughout United States.

Control.—Plant only virus-free, aphid-free stock. Locate new plantings as far as possible from existing strawberry fields. Plow under old fields immediately after the last harvest season.

To control aphids in spring before the fruit is set, or to control them after a harvest, spray with demeton. If aphids become abundant after the fruit is set, apply endosulfan, malathion, mevinphos, or parathion in a dust or spray; or, apply carbophenothion, demeton, or diazinon in a spray.

Do not use malathion or parathion if the cyclamen mite is a pest in your area. Do not apply demeton within 21 days before a harvest; parathion within 14 days; diazinon within 5 days; endosulfan within 4 days; malathion or carbophenothion within 3 days; or mevinphos within 1 day.

In areas where virus diseases are a problem, control the aphids in fall and spring to prevent a buildup of winged aphids, which spread viruses. Apply demeton about September 1, and again in about 3 weeks if any aphids are still present. Apply demeton in early spring before the plants begin to bloom. If insecticide control is needed after the fruit is set, apply carbophenothion, endosulfan, mevinphos, malathion, or diazinon.

Strawberry Root Aphid

Description and habits.—Soft-bodied insect; about 1/16 inch long when fully grown. Color ranges from yellowish green to dark bluish green or black. All stages are found on stems of plants,

and on underside of leaves; they are found on roots when the aphids have been carried underground by ants. Only the eggs survive subzero temperature in Northern States, but all forms survive milder winters in Southern States.

Damage.—These aphids suck sap from foliage, and cause more serious damage by feeding on roots. They do not cause leaf distortion, but infested plants lack vigor, have smaller, pale leaves, and produce immature, or dry fruits. Aphids may weaken or kill new plants before they become established.

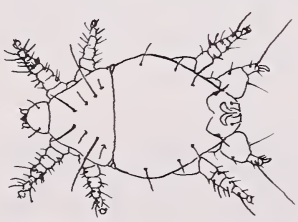
Distribution.—East of the Rocky Mountains.

Control.—Before setting plants, dip them for 1 minute in an emulsion containing 1 pint of 25-percent demeton emulsifiable concentrate in each 50 gallons of water. If foliage becomes infested after planting, apply a demeton spray (see table on page 2). If you find aphids on roots, control the ants that put them there (see *Cornfield Ant*, page 8).

Do not apply demeton within 21 days before a harvest. Wear rubber gloves when dipping plants, and when handling treated plants.

Mites

Cyclamen Mite



BN–7359-X

Description and habits.—Adult is smooth, tiny, whitish to caramel-colored mite; immature mite is milky white; eggs are oval and pearly white. All forms occur together in crevices of leaves, on stems, and among hairs of plants; they are not visible to the naked eye.

Mites live on young, folded leaves, in center of plant crowns. Activity is greatest in spring and fall. Adult females overwinter in crowns, and at bases of petioles of leaves. Immature stages of development may be completed in less than 2 weeks, making rapid increase possible.

Damage.—Mites feed on young, expanding leaves in crowns of plants. They cause severe distortion, stunting, and bronze discoloration, and sometimes kill the leaves. They feed on blossoms, causing distortion of the fruit. Usually, infested plants become unproductive within a season.

Control.—When established, the cyclamen mite is difficult to control. You may prevent damaging infestations from occurring by planting only uninfested or treated plants.

To treat dormant plants, immerse them for 20 minutes in water preheated to 100° F.; keep the water at this temperature during immersion. Loosen tied bundles of plants to allow even penetration of heat.

An alternate treatment is to fumigate plants for 2 hours at 70° F. See that the plants have reached the temperature of 70° before starting to fumigate. Use 2 pounds of methyl bromide for each 1,000 cubic feet of enclosed space. Control the temperature thermostatically, and provide air circulation. After plants have been fumigated, pack them in boxes with moist sphagnum moss on bottoms, sides, and tops; moisten plants to prevent dry-

Caution

Methyl bromide is highly toxic and may cause death if swallowed, inhaled, or absorbed through the skin.

ing; do not plant within 48 hours after fumigation.

Cyclamen mites may be killed by hot, dry summers in some areas. Sometimes they are kept under control by predatory insects.

The use of parathion or malathion to control any pest may also kill the beneficial insects that destroy mites. Then there will be a rapid buildup of the cyclamen mite population. *Parathion or malathion should not be used on strawberries in areas where the cyclamen mite occurs.*

Endosulfan may be used to control cyclamen mites. Mix a material containing ½ pound of active endosulfan ingredient in each 100 gallons of water; apply 800 gallons of this mixture to each acre. When endosulfan is applied at this rate, allow an interval of at least 35 days between applications. Do not make an application within 4 days before a harvest.

In California, fumigation of infested fields with methyl bromide, under gastight covers, has been used successfully. It is done during the dormant season, or between crops in June or July at temperatures below 80°, or at night. If you use this method, cover rows with specially treated tarpaulins or polyethylene sheets; fumigate for 2 hours, using 2 pounds of methyl bromide for each 1,000 square feet. If temperature is as low as 50° to 65°, use 3 pounds of methyl bromide, and fumigate for 3 hours. Some superficial damage may occur, but there will be quick recovery. Consult your county agricultural agent for further information about this treatment.

Spider Mites

TC–7138

Description and habits.—Several species. Adults are about 1/60 inch long; barely visible to the naked eye. Color ranges from pale greenish yellow to deep red; usually there are 2 to 4 dark spots along the back. These mites generally form webs on the undersides of leaves. During favorable weather, they complete a generation in 10 days to 2 weeks, making it possible for mite populations to increase rapidly. They pass the winter on strawberry plants, or on weeds in or around old strawberry fields.

Damage.—Spider mites feed on undersides of leaves, and suck out plant juices. Injured foliage turns yellow, and develops rusty brown blotches. Plants may become stunted, and yield may be greatly reduced.

Distribution.—Throughout United States.

Control.—Spider mites have many natural enemies that often keep them in check, but sometimes heavy infestations follow warm weather in spring. Examine undersides of leaves frequently during the dormant and spring season; look for the tiny mites, and signs of their webbing.

If you find a few mites in several sections of a field, apply spray containing demeton or apply dust or spray containing dicofol, diazinon, carbo-

phenothion, or tetradifon (see table on page 2). Repeat treatment if necessary. It is important to start treatments early, before heavy infestations are well established. A heavy infestation usually requires several insecticide applications during a season.

Demeton will give excellent control of spider mites and aphids for several weeks. Do not apply dicofol within 2 days, or demeton within 21 days, before a harvest. Do not use carbophenothion or tetradifon within 3 days, or diazinon within 5 days, of harvest. Do not repeat tetradifon applications within 35 days.

Weevils

Root Weevils

TC–7133

Descriptions and habits.—There are two groups of root weevils, each containing several species. Weevils of one group are black, and 1/5 to 2/5 inch long. They include the strawberry root weevil; the rough strawberry root weevil; and the black vine weevil, which is the largest. Weevils of the other group are gray, and about 1/4 inch long. They include the Lacomb strawberry root weevil and the western strawberry root weevil. Larvae of both groups are white and have tan heads. They are thick bodied, legless, and 1/4 to 1/2 inch long when fully grown.

Adults of the black group emerge from the soil between late May and September; gray adults emerge late in fall. Females lay eggs in the soil near strawberry plants during spring and early summer. Eggs hatch in a few days, and the small larvae begin feeding on roots of strawberry plants. Larvae of black weevils overwinter and change to adults the following spring; larvae of gray weevils reach maturity and change to adults in winter.

Damage.—Adults eat out notches in leaves, but this injury is not important. Larvae cause serious damage by feeding on roots and crowns of plants. Root feeding stunts and weakens plants; girdling of the crowns kills them.

Distribution.—Northern parts of the U.S., particularly Washington and Oregon. Black root weevils occur in the northern and northeastern parts of the United States, and in the Pacific Coast States. Gray root weevils occur throughout the Northern States, and in cooler parts of the Pacific Coast States.

Control.—If the cyclamen mite is not a pest in your area, you can control adult root weevils by applying malathion or parathion, either in a dust or in a spray. Do not apply malathion within 3 days, or parathion within 14 days, before a harvest.

The most effective way, by far, to control root weevils is to spray the soil with insecticide before setting out the plants. Apply chlordane at the rate of 10 pounds per acre. After application, thoroughly mix the insecticide into the top 6 inches of soil by disking. Strawberries can be planted any time after the insecticide has been thoroughly worked into the ground. This

treatment will also help to control wireworms, white grubs, cutworms, and many other soil-inhabiting insects. Do not repeat chlordane soil treatment within 3 years.

Strawberry Crown Borer

Description and habits.—Adult is a snout beetle; about 1/5 inch long; dark brown; has six darker spots on back. Larva is legless grub; 1/5 inch long when fully grown; white. Adults occur in strawberry fields throughout the year; they lay eggs from March to August. Larvae bore down into crowns of plants; become fully grown by fall, and change to adults that remain in or among plants during winter.

Damage.—Adults feed on foliage; seldom cause serious injury except to new plantings. Larvae cause greatest damage. A larvae-infested plant becomes weakened, and may die if there is extensive tunneling of the crown by several larvae.

Distribution.—Throughout United States, except Rocky Mountain States and other high-altitude areas.

Control.—These insects cannot fly or crawl more than 300 feet; therefore, the best way to prevent infestation is to locate new plantings more than 300 feet from old strawberry fields or from wild strawberry growths. Select new plants that are free from crown borer eggs, larvae, pupae, and adults; or, use plants that have been treated (see page 4). Plow up old plantings immediately after harvest.

If your field is infested, you may control adults and prevent egg laying by dusting or spraying with toxaphene; apply in spring when plants are beginning to bloom. In heavily infested fields, a second application may be necessary after harvest. Do not apply toxaphene after fruit is on the plant.

Strawberry Weevil

Description and habits.—Adult is snout beetle; about 1/10 inch long; has doubled-under snout about half as long as body; chestnut brown; has two black spots on back. Larvae is curved grub; about 1/10 inch long; creamy white.

Adults leave their hibernation quarters (debris of woodlands, or hedges) in early spring, and move to strawberry fields. Females puncture strawberry buds with their long beaks, and deposit eggs singly. Then they girdle the stems, causing buds to fall or to hang on the stems by a few shreds. Larvae feed and develop inside buds. Adults emerge in early summer and feed on the pollen of flowers for a short time. They go into hibernation by midsummer, and remain there until the following spring.

Damage.—Adults sever stems of fruit buds, causing them to hang by part of the stem or fall to the ground; this prevents formation of fruit. These insects eat holes of irregular shape in petals and other parts of blossoms.

Distribution.—Eastern half of United States, Texas, Colorado, and Kansas.

Control.—Apply methoxychlor at first sign of damage to flower buds. Re-treat after 10 days or 2 weeks, if needed. Do not apply methoxychlor within 3 days before a harvest.

Other Pests

Cornfield Ant

Description and habits.—Several species. Worker ants are soft-bodied insects; 1/12 to 1/10 inch long; light to dark brown. They feed on honeydew excreted by aphids, and are found attending and protecting aphids on strawberry roots.

Damage.—Ants transport root aphids to the crowns and main roots of plants; they make tunnels and chambers to accommodate the aphids. This causes the soil and roots to dry out. Most damage is done by aphids feeding on the roots.

Distribution.—Throughout United States.

Control.—Ants may be controlled by crop rotation, clean cultivation, and fertilization for thrifty growth of plants. Do not plant strawberries to follow corn, weeds, or grass. Do not plant near old strawberry fields, or on land that has grown strawberries during the previous 3 years. Practice deep plowing during the fall season when ants swarm; this will drive ants away, and the queen ants will avoid bare land when looking for suitable places to start new colonies. Cultivate often; keep fields free of weeds and grasses.

You can control ants over small areas by applying a chlordane drench to infested soil. Use 5 ounces of 40-percent wettable powder, or 4 fluid ounces of 45-percent emulsifiable concentrate, mixed in 100 gallons of water. This makes enough drench to treat 1,000 square feet. Before transplanting, you can destroy many ant colonies by treating the soil with chlordane, as recommended for control of root weevils (see page 6).

Cutworms

EPQ–1911

Description and habits.—Many species. Adults are moths; dull, gray or brownish yellow; they fly at night. Larvae are stout, soft bodied, smooth; up to 1¼ inches long; dull gray, brown, or black; may be striped or spotted. They curl up tightly when disturbed.

Larvae feed on plants at night. During the day, they usually hide in a curled position in soil near the plants. On dark, cloudy days they sometimes appear above ground. Most cutworms pass winter in the larval stage, hidden in soil, under trash, or in clumps of grass. They resume feeding in spring, and grow until early summer. Then, the mature larvae change to pupae beneath the soil surface, and the pupae change to moths. The moths emerge from the soil, and females soon lay eggs for another generation of cutworms.

Damage.—Cutworms cause severe damage by cutting off new plants at ground level, and by chewing the foliage of old plants.

Distribution.—Throughout United States.

Control.—Apply toxaphene dust or spray to soil surface.

Some species of cutworms feed above the soil surface. To control these, you

can use a ready-mixed bait containing 3 percent of toxaphene. Spread bait at the rate of 20 pounds per acre; spread it in the afternoon, so it will be fresh and moist when cutworms come out of the ground to feed.

To protect a new planting where cutworms are present, apply insecticide several days before setting out the plants. Do not apply toxaphene when fruit is on the plants.

Field Cricket

Description and habits.—Adult is a jumping insect; body from $\frac{3}{5}$ to 1 inch long; squarish back; antennae longer than body; hind legs very heavy, for jumping; usually black. Female has needlelike ovipositor almost as long as body. These insects vary in color, length of wings, and other structural features.

In Northern States, field crickets overwinter in the egg stage, and complete a single generation in a year. In Southern States they overwinter as nymphs; or they remain more or less active throughout the year, and produce several generations.

During sunny days the crickets seek shelter under vegetation or trash, or in cracks or excavations that they make in the soil. From late afternoon to late morning they feed, mate, and lay eggs. They lay eggs in damp soil along ditches, and beneath cracks in baked soil.

Damage.—During fall, field crickets gnaw away the outer bark of runner plants, and kill the runners. During spring, they feed on developing fruit buds, blossoms, and fruit in all stages. They may destroy all buds and blossoms. Injured, immature fruit may develop into knotty, dwarfed berries. When crickets gnaw ripe fruit, the injury is quite apparent.

Distribution.—Throughout United States.

Control.—Apply 3-percent chlordane bait to soil surface at the rate of 40 pounds per acre. Apply it in late afternoon, after rain or irrigation. Or, you may use malathion on foliage as needed; do not apply it within 3 days before a harvest.

Flea Beetle

ENT–1788

Description and habits.—Adult is a jumping beetle; about $\frac{1}{6}$ inch long; shiny, greenish metallic bronze. Mature larva is hairy, about $\frac{3}{16}$ inch long; dull yellowish to dark olive green. Adults hibernate in winter, and appear in spring to lay eggs on strawberry foliage. One generation of these insects occurs in a year in northern regions; two generations occur in southern regions. Usually, they are not seen during hot weather, but appear with cool weather in the fall.

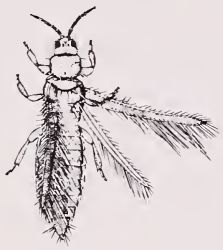
Damage.—Adults and larvae feed on leaves, flowers and young fruit. Damaged leaves are riddled with small holes.

Distribution.—Throughout United States.

Control.—Practice clean culture; this is important because the beetles

prefer to feed and breed on evening primroses. If infestation is present, apply methoxychlor. Do not apply methoxychlor within 3 days before a harvest.

Flower Thrips



EPQ–2012

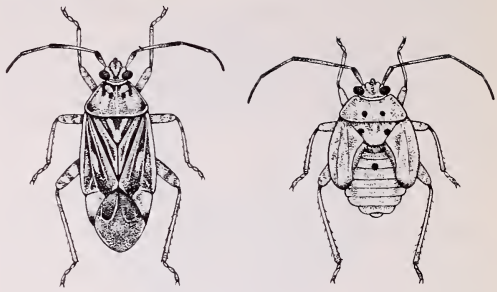
Description and habits.—Several species. Adults are slender, winged, and active; about $\frac{1}{25}$ inch long; orange or yellow. Young thrips are smaller, wingless, yellowish. These insects breed on grasses and weeds in spring, and move to strawberries at blooming time. They insert their eggs in plant tissue at the base of flowers, and in tender, new foliage.

Damage.—Thrips feed in and on the blossoms. They make numerous, very shallow punctures on tender parts of flowers from which they suck out plant juices. Injured blossoms drop off; or the young berries may remain hard and brown, and fail to grow. Damage is more prevalent during dry seasons.

Distribution.—Throughout United States.

Control.—Thrips seldom become so abundant that control is required; a heavy infestation is necessary to reduce the set of fruit. If you experience a severe infestation, apply malathion in a dust or spray. Do not apply malathion within 3 days before a harvest.

Lygus Bug



Adult Nymph

TC–3342

Description and habits.—Adult is flat bug; about $\frac{1}{4}$ inch long; brownish, marked with yellowish and black dashes; has brassy appearance. Young nymphs resemble wingless aphids, but are more active. Adults overwinter on herbaceous weeds, clover, alfalfa, and on other plants in protected places; they may appear in strawberry fields in spring, before the plants bloom.

Damage.—Adults and nymphs feed on blossoms and newly formed fruits, causing "buttoned" berries. While feeding, this pest injects into the plant a poisonous substance that kills tissue. Injured berries take on a woody texture, and fail to mature.

Distribution.—Throughout United States.

Control.—If nymphs are present when the first blooms appear, dust or spray with malathion or parathion. Do not apply malathion within 3 days, or parathion within 14 days before a harvest.

Mole Crickets

Description and habits.—Several species. Large, beady eyes; short, stout front legs; shovellike feet, used for digging; about $1\frac{1}{3}$ inches long and $\frac{1}{4}$ inch wide; light brown; undersur-

face of body is lighter brown, often tinged with green. These insects spend most of their time in permanent burrows, several inches below soil surface; during cold weather they dig the burrows deeper.

Damage.—Mole crickets feed on roots, and burrow in the upper inch or two of soil about the roots. Infested plants dry out or become uprooted. Transplants are especially subject to injury. Ripening berries are a favorite food when these crickets are feeding above the soil surface at night.

Distribution.—South Atlantic and Gulf Coast States.

Control.—Mole crickets usually can be controlled with insecticide bait because they come to the soil surface at night to feed. Apply 3-percent chlordane bait to the soil surface, at the rate of 40 pounds per acre. Apply it in late afternoon, after rain or irrigation. Several applications may be needed, at 10-day intervals. Do not apply chlordane when fruit is on the plants.

Omnivorous Leaf Tier

Description and habits.—This insect is also called the strawberry worm, flax worm, or tie worm. Adult is a tan moth; about ½ inch long; female has brown spots on forewings. Larva is light cream color; has lighter stripe along each side of back; tan head; about ⅝ inch long when fully grown. Pupa is cigar-shaped, and brown; found inside strawberry fruits or in webbed foliage.

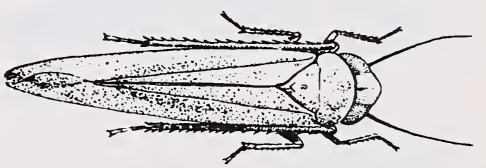
Adults fly on calm evenings during June and July. Females lay eggs on rough bark of trees or on rough wood. Eggs hatch into tiny worms, or larvae, which conceal themselves in crevices where they pass the winter. They emerge in spring, and spin silken threads on which they are carried by the wind into nearby fields.

Damage.—Larvae feed first as leaf miners or between folded new leaflets of strawberries. Later, they fasten down one or two flower petals and feed on the developing fruit beneath. When one side of a berry becomes ripe, the larvae bore into the fruit under the calyx.

Distribution.—Pacific Coast.

Control.—Avoid planting strawberries near rough-barked trees in areas where the omnivorous leaf tier is present. Do not plant strawberries to follow legumes. If leaf tiers are present, apply 5-percent methoxychlor dust about 15 days after blossoms appear; make a second application 3 weeks later. Do not apply methoxychlor within 3 days before a harvest.

Potato Leafhopper



TC–7112

Description and habits.—Adult is a green insect; ⅛ inch long; flies quickly when disturbed. Young nymph is tiny; light green; easily identified by its habit of moving sideways when disturbed.

Female adults deposit eggs within leaves and stems of strawberry plants; nymphs develop on the underside of leaves. Nymphs are most active from June to August.

Damage.—Adults and nymphs feed along the veins on the underside of strawberry leaves; they suck juices from the tissue. While feeding, they inject saliva into the leaves. This plugs the sap-conducting vessels, and causes the leaves to become curled and stunted. Young plants suffer the most serious injury.

Distribution.—Throughout eastern half of United States.

Control.—Apply malathion or parathion dust or spray. Do not apply malathion within 3 days before a harvest, or parathion within 14 days.

Snails and Slugs

EPQ–1917

EPQ–1910

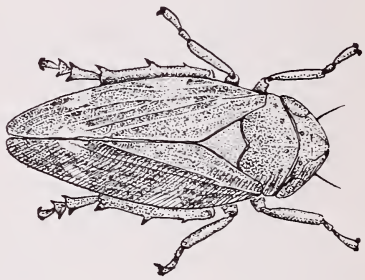
Description and habits.—Many species. Snails have shells that vary in color from nearly white to brown or black, and may be striped or mottled with contrasting colors; usually ½ to 1 inch in diameter when fully grown; bodies are wormlike, legless, slimy, and grayish. Slugs do not have shells; are usually mottled with shades of gray, but may be whitish yellow, brown, or black; ½ to 4 inches long when fully grown. Snails and slugs feed at night, and hide during the day in damp refuse.

Damage.—Snails and slugs feed on berries and foliage. They eat out large, irregular areas, and leave a glistening trail of slime.

Distribution.—Throughout United States, particularly on Pacific Coast.

Control.—These pests are controlled by the use of commercial baits. Follow directions on the label. Make sure the label gives directions for use on strawberries to control snails and slugs.

Spittlebugs



BN–7363

Description and habits.—Several species. Adult is froghopper; about ¼ inch long; dull brown, or mottled gray. Newly hatched nymphs are bright yellow. Spittlebugs overwinter in the egg stage; eggs are laid in masses of 2 to 20 in a row, attached to stems and leaves of strawberry and other plants. Eggs hatch in late March, April, or May. Newly hatched nymphs feed on new growth, sucking out the juices. They produce a frothy material that covers their bodies. In 5 to 8 weeks, nymphs reach full growth; the froth dries up, and adults emerge.

Damage.—Nymphs suck out plant juices from tender leaves and fruit; they weaken growth, and stunt the berries. Nymphs often attack flowerbud clusters, leaf stems, and young growth

in the crowns. Adults are present most of the summer, but do not cause perceptible damage. Spittlebugs are a nuisance to pickers, who dislike coming in contact with masses of "spittle" while picking berries.

Distribution.—Northern States.

Control.—Apply methoxychlor, malathion, or endosulfan, dust or spray. Make applications after the first blossom clusters separate; this occurs before the first small masses of froth become noticeable. Be sure the insecticide penetrates blossom clusters. Do not apply endosulfan within 4 days before a harvest, or methoxychlor or malathion within 3 days.

Strawberry Crown Moth

Description and habits.—Adult is a clear-winged, day-flying moth, resembling a small yellow jacket in color and size. Larva is almost 1 inch long when fully grown; white to pinkish; has brown head. Adults lay eggs in midsummer on undersides of leaves, near crowns of plants. Newly hatched larvae bore into crowns. They become full grown in the fall, remain in crowns until the following summer, then pupate and become moths.

Damage.—Larvae mine into crowns of plants. Infested plants become sickly, and may die.

Distribution.—Pacific Coast.

Control.—There is no satisfactory chemical control for this pest. Remove and burn infested plants in spring, before the moths emerge. You can further control infestation in this way: Top the plants immediately after harvest; leave several rows untopped, on which the moths will lay eggs; plow under or burn the untopped rows in September or October.

Strawberry Rootworm

TC–7132

Description and habits.—Adults are oval beetles; shiny dark brown or black; some have four dark spots on wings; about $\frac{1}{8}$ inch long. Larvae are small, white, brown-spotted grubs; they feed on the roots of strawberries in early summer. Adults overwinter among old leaves, straw, or trash; in spring, they feed on leaves. Females lay eggs in the soil close to plants and on undersides of dead leaves lying around the plants. Newly hatched larvae burrow into the soil; there they develop, and emerge as beetles during summer.

Damage.—Adults eat holes in leaves. Larvae feed on rootlets of strawberry plants.

Distribution.—Throughout United States.

Control.—This insect seldom does enough damage to warrant application of insecticide. If the beetles become very abundant, you can control them by applying methoxychlor dust or spray. Do not apply methoxychlor within 3 days before a harvest.

Strawberry Leaf Roller

Description and habits.—Adult is a moth; less than $\frac{1}{2}$-inch wingspread; rusty red; brown and white markings. Larva is up to $\frac{1}{2}$ inch long when fully grown; color ranges from pale green

TC–3080

Injury to strawberry leaves by strawberry rootworm.

TC–2509

Rolled leaves of strawberry plant, containing larvae of strawberry leaf roller.

to gray brown. Larvae are found near silken tunnels on undersides of leaflets. They occur also on upper surfaces inside rolls which they make by folding the leaflets along the midrib with silken threads. Two or three generations of leaf rollers occur each year—one at harvesttime, and the others following at 5- to 7-week intervals.

Damage.—Larvae feed on lower and upper leaf surfaces. They roll, fold, and tie leaves together with silken threads. This causes withering of leaves and fruits.

Distribution.—Throughout United States, except Southwest.

Control.—Parasites usually control this pest; insecticide is seldom needed when there is an average of only one or two larvae on each plant. If the infestation is larger, dust or spray with carbaryl, parathion, or malathion. Do not apply parathion within 14

days, malathion within 3 days, or carbaryl within 1 day before a harvest.

Strawberry Whitefly

Description and habits.—Adult resembles small moth; about 1/16 inch long; wings and body covered with whitish powder. Larva is scalelike; covered with waxy excretion; overwinters in the egg stage in cold regions.

Damage.—Larvae suck out plant juices. They excrete large quantities of honeydew that supports a sooty mold. Foliage of infested plants loses vitality, and may decay.

Distribution.—Throughout United States.

Control.—If larvae are abundant, dust or spray with malathion, or parathion. Do not apply parathion within 14 days, or malathion within 3 days before a harvest.

White Grubs

C&F–2526

Description and habits.—White grubs are the larvae of many species of May beetles, which are also called June beetles in the northern States and in Canada. Mature grubs have soft, curved, white bodies; whitish brown heads; six legs; are 3/4 to 1 inch long.

The most injurious species of this insect has a 3-year life cycle. Grubs hatch during summer, from eggs laid by beetles in the spring. Each year in fall, for 2 years, the grubs burrow deep into the soil, below the plowline. There they overwinter. In spring they return near the surface and pass the summer months. During the summer of the third year, they pupate in soil above the plowline. There, they change to adult beetles and remain throughout the following winter. During the next spring and early summer, the beetles appear above ground at night to feed and mate. They return to the soil during the day to lay eggs for another generation.

Damage.—White grubs feed on roots of strawberry plants, and either kill or severely weaken them. Grubs cause greatest damage in the second and third year of their development. Grassland is likely to be infested with them. Adult beetles feed at night on leaves of trees—especially oak, elm, ash, poplar, willow, locust, walnut, and pine.

Distribution.—Throughout United States.

Control.—Do not plant strawberries in newly plowed grassland. You can reduce the danger of insect damage by rotating crops, and by cleanly cultivating the crop that precedes strawberries. If your field is infested, apply chlordane to the soil before planting, as for control of root weevils (see page 6).

Wireworms

TC–7144

Description and habits.—Many species. Adults are elongated, hard-shelled

click beetles. The worms, or larvae, are hard, smooth, wiry; brown and yellow: ½ to 1 inch long. Adults emerge in spring and lay eggs in moist soil. Larvae hatch from the eggs; they live in the soil and feed on roots of plants. It may take several weeks for larvae to reach maturity.

Damage.—Larvae feed on roots; they may stunt or kill small plants. Damage is most likely to occur if strawberries are planted after sod has been plowed.

Distribution.—Throughout United States.

Caution

Do not transfer ethylene dibromide from one container to another in a closed room; do not breathe the fumes.

Control.—Do not plant strawberries in soil that has recently been in sod. Before planting, treat soil with chlordane, as for root weevils. Fumigation of the soil with ethylene dibromide for nematodes will also control wireworms; do not use this treatment within 3 weeks before planting.

PRECAUTIONS

Pesticides used improperly can be injurious to man, animals, and plants. Follow the directions and heed all precautions on the labels.

Store pesticides in original containers under lock and key—out of the reach of children and animals—and away from food and feed.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish, and wildlife. Do not apply pesticides when there is danger of drift, when honey bees or other pollinating insects are visiting plants, or in ways that may contaminate water or leave illegal residues.

Avoid prolonged inhalation of pesticide sprays or dusts; wear protective clothing and equipment if specified on the container.

If your hands become contaminated with a pesticide, do not eat or drink until you have washed. In case a pesticide is swallowed or gets in the eyes, follow the first aid treatment given on the label, and get prompt medical attention. If a pesticide is spilled on your skin or clothing, remove clothing immediately and wash skin thoroughly.

Do not clean spray equipment or dump excess spray material near ponds, streams, or wells. Because it is difficult to remove all traces of herbicides from equipment, do not use the same equipment for insecticides or fungicides that you use for herbicides.

Diazinon, endosulfan, and toxaphene can be absorbed through the skin in harmful quantities. When working with these insecticides in any form, take extra care not to let them come in contact with the skin.

Carbophenothion, demeton, methyl bromide, mevinphos, and parathion are highly toxic and may cause death if swallowed, inhaled, or absorbed through the skin. These insecticides should be applied only by a person thoroughly familiar with their hazards who will assume full responsibility for safe use.

Dispose of empty pesticide containers promptly. Have them buried at a sanitary land-fill dump, or crush and bury them in a level, isolated place.

NOTE: Some States have restrictions on the use of certain pesticides. Check your State and local regulations. Also, because registrations of pesticides are under constant review by the Federal Environmental Protection Agency, consult your county agricultural agent or State Extension specialist to be sure the intended use is still registered.

Pesticide residues.—To prevent excessive residues on harvested fruit, do not apply dosages heavier than those recommended. When fruit is present, do not apply toxaphene or chlordane. Do not apply the following insecticides within the indicated number of days before a picking:

	Days
Demeton	21
Parathion	14
Endosulfan	4
Diazinon	5
Carbophenothion	3
Malathion	3
Tetradifon	3
Methoxychlor	3
Dicofol	2
Mevinphos	1
Carbaryl	1

Do not apply tetradifon during the fruiting period at intervals of less than 35 days. Do not repeat applications of endosulfan at intervals of less than 15 days, or more than twice within a 35-day period when fruit is present.

If you have an insect problem that is not covered in this bulletin, write to your county agricultural agent, to the agricultural college or Department of Agriculture in your State, or to the U.S. Department of Agriculture, Washington, D.C. 20250. When writing for information, send specimens of the insects or related pests; mail them in a small bottle of rubbing alcohol. Or, send samples of damaged parts of the plants. Do not send live insects through the mail.

U.S. GOVERNMENT PRINTING OFFICE : 1975—O-570-022

Prepared by
Northeastern Region
Agricultural Research Service